Brief Communications

Six stitches to create a neosinus in David-type aortic root resuspension

Anton Moritz, MD, PhD,[a] Petar Risteski, MD,[a] Selami Dogan, MD,[a] Hakan Macit, MD,[a] Birkan Akbulut, MD,[a] Andreas Zierer, MD,[a] and Tayfun Aybek, MD,[b] Frankfurt, Germany, and Ankara, Turkey

In the past decade, aortic valve–sparing procedures for aortic root dilatation have gained popularity among surgeons.[1] The David technique, originally described as reimplantation of the aortic valve in a cylindric tube graft (David I), has been shown to be associated with certain drawbacks, particularly increased leaflet stress during opening and closing[2] and possible abrasion of the leaflets as they touch the prosthetic wall. Furthermore, the lack of sinuses may affect the coronary flow.[3] Since 1992, this technique has undergone several modifications and refinements[4] to avoid these imperfections.

Various attempts to restore the sinuses of Valsalva during the valve-sparing procedure have been reported.[2,4,5] A specially designed prosthesis with a bulge at the base is now available (Sulzer Vascutek, Renfrewshire, United Kingdom). These modifications, however, do not create tear-shaped, natural sinuses for a trilobed aortic root but rather result in an ectatic and evenly spherical bulge that accommodates the natural valve. We present a simple and reliable modification to create trilobed neosinuses in a Dacron polyester fabric tube graft to more closely resemble the natural aortic root.

Technique

The base of the aortic root is dissected circumferentially for adequate exposure. The sinuses of Valsalva are excised, leaving approximately 4 to 5 mm of aortic wall adjacent to the insertion line of the leaflets. In acute dissections, the wall layers of the aortic root are reconstructed at this point with gelatin-resorcin-formol surgical glue (Colle Chirurgicale; Cardial SA, St Etienne, France) or sutures.

In patients with a normal and nondilated annulus, the graft is matched to the annular diameter, adding about 2 mm for aortic wall thickness. For creation of the neosinuses, an additional 5 to 7 mm is added.

The graft is slightly beveled to account for the ventricular muscle extension into the commissure between the right and left coronary sinuses. Three neosinuses are shaped by plicating the base of the graft with three 4-0 braided polyester sutures. At the base of each commissure, 5- to 7-mm bites (depending on the amount of planned diameter reduction) are passed parallel to the lower edge of the prosthesis. The second bite of the same suture is passed perpendicularly to the first to catch 5 to 7 mm of prosthesis height (Figure 1, *1* and *2*). Placing three stitches at the base in such fashion reduces the diameter and local height of the base and provides a more physiologically rounded triangular shape. Transmural mattress sutures are placed just below the leaflet insertion to the aortic wall. These sutures are then passed through the graft and tied. The valve is resuspended with pledgeted polypropylene sutures above the commissures. Bites are taken 5 to 7 mm wider at the prostheses. This creates the anatomic diameter reduction of the sinotubular junction. Again, three 4-0 stitches are placed at the outside to reinforce the diameter reduction, and the perpendicular bites again reduce the height at the commissures to increase the bulge of the sinuses (Figure 1, *3* and *4*). Finally, the aortic wall remnant is sutured to the graft with a continuous mattress suture and the coronaries are reimplanted.

From the Department of Thoracic and Cardiovascular Surgery, Johann Wolfgang Goethe University, Frankfurt, Germany,[a] and the Department of Cardiovascular Surgery, Güven Hospital, Ankara, Turkey.[b]

Received for publication Aug 31, 2006; accepted for publication Sept 13, 2006.

Address for reprints: Tayfun Aybek, MD, Department of Thoracic and Cardiovascular Surgery, Johann Wolfgang Goethe University, Theodor Stern Kai 7, 60590 Frankfurt/M, Germany (E-mail: Tayfun@Aybek.de).

J Thorac Cardiovasc Surg 2007;133:560-2

0022-5223/$32.00

doi:10.1016/j.jtcvs.2006.09.036

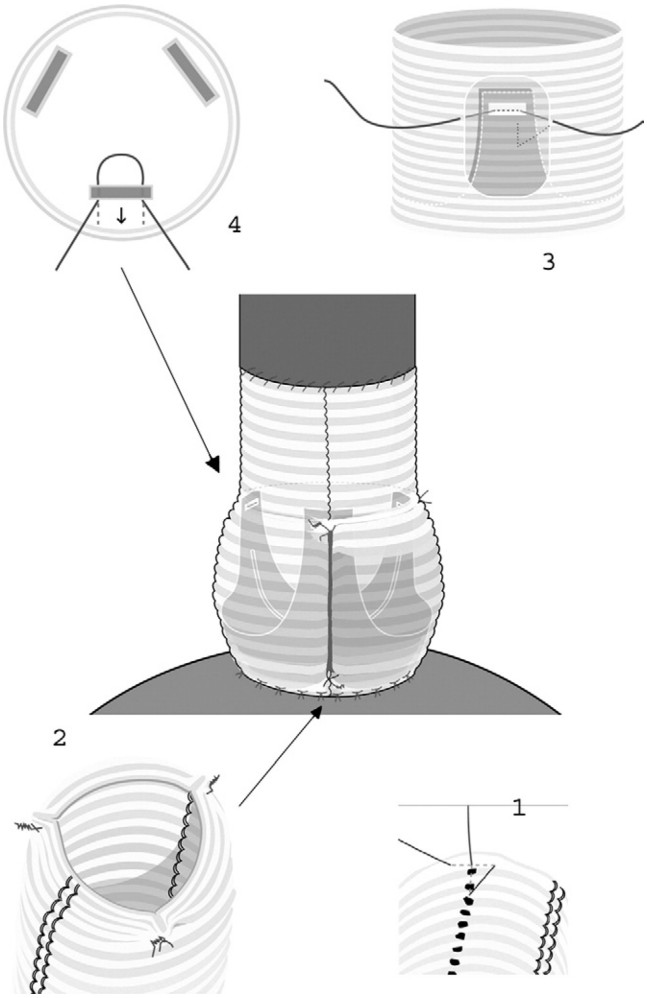

Figure 1. Creation of neosinus. 1, 4-Forming suture at prosthesis base to plicate and stretch commissural column; 2, view of prosthetic base after three plication sutures; 3 and 4, after seating of prosthesis in aortic root, commissures are resuspended with pledget-armed 4-forming sutures.

Discussion

The sinuses of Valsalva and their flow dynamics have an important influence on cusp dynamics and coronary flow. The natural radicular expansion of the aortic root cannot be approximated by this type of repair. Modifications of the David operation[4] create pseudosinuses with plication sutures at both the base and the sinotubular junction of the graft. Placing only three sets of plication sutures, however, reducing height and diameter, allows generation of a root better resembling the natural trilobed geometry. The nearly normal anatomy was demonstrated in control computed tomographic scans (Figure 2). In addition, there is no need for a second, smaller tube graft above the sinotubular junction[4] or of a prosthesis-to-prosthesis suture line. This technique is safe and simple to perform, and we believe it is more reproducible as an attempt to recreate the physiologic geometry of the root. It is easy to individually tailor in case of uneven distribution of the commissures, different heights of the commissures, or other variations seen as a result of root dilatation or aortic incompetence.

The only graft that incorporates sinuses of Valsalva, the Valsalva graft (Sulzer Vascutek), as introduced by De Paulis and associates,[3] is limited by the predetermined height of the sinus portion and fixed diameters of the large and small parts of the graft, making it unsuitable for some patients with very high commissures, particularly some with Marfan syndrome. The base of the graft is even and thus does not follow the muscular shelf of the septum. It is therefore sometimes difficult to position the lower ring of the graft below the aortic valve insertion.

We have performed our first modification since 2000, creating pseudosinuses in 47 patients with good perioperative clinical and echocardiographic results. In addition, measurements of root dynamics with echocardiographic M-mode technique showed significant stress reduction on the aortic leaflets and absence of leaflet strike on the graft wall. The final change presented here restores nearly normal aortic root geometry and can be easily modified to accommodate various anatomic situations.

Figure 2. Postoperative computed tomographic scan. A, Longitudinal view depicting neosinuses; B, short-axis showing trilobed root form.

References

1. David TE, Feindel CM. An aortic valve–sparing operation for patients with aortic incompetence and aneurysm of the ascending aorta. *J Thorac Cardiovasc Surg.* 1992;103:617-21.
2. Leyh RG, Schmidtke C, Sievers HH, Yacoub MH. Opening and closing characteristics of the aortic valve after different types of valve-preserving surgery. *Circulation.* 1999;100:2153-60.
3. De Paulis R, De Matteis GM, Nardi P, Scaffa R, Bassano C, Chiariello L. Analysis of valve motion after the reimplantation type of valve-sparing procedure (David 1) with a new aortic root conduit. *Ann Thorac Surg.* 2002;74:53-7.
4. Demers P, Miller DC. Simple modification of "T. David-V" valve-sparing aortic root replacement to create graft pseudosinuses. *Ann Thorac Surg.* 2004;78:1476-81.
5. Cochran RP, Kunzelman KS, Eddy AC, Hofer BO, Verrier ED. Modified conduit preparation creates a pseudosinus in an aortic valve-sparing procedure for aneurysm of the descending aorta. *J Thorac Cardiovasc Surg.* 1995;109:1049-58.

An entirely endovascular approach to the repair of an ascending aortic pseudoaneurysm

Firas F. Mussa, MD,[a,b] Scott A. LeMaire, MD,[a,c] John Bozinovski, MD,[a,c] and Joseph S. Coselli, MD,[a,c] Houston, Tex

Traditional surgical repair of an ascending aortic pseudoaneurysm requires resternotomy, cardiopulmonary bypass, and often hypothermic circulatory arrest. These procedures are complex, technically challenging, and associated with significant mortality.[1] The rapidly advancing technology of catheter-based interventions has rarely addressed diseases of the ascending aorta, because the proximity to the coronary and brachiocephalic arteries makes such interventions particularly challenging.[2-4] Here we describe the use of a stent-graft to perform an entirely endovascular repair of a symptomatic ascending aortic pseudoaneurysm in a patient who was a poor candidate for open surgical intervention.

Clinical Summary

Review of patient data for this report was approved by the institutional review board at Baylor College of Medicine. Informed consent for the report was obtained from the patient. An 82-year-old woman had undergone emergency repair of an acute iatrogenic dissection localized to the ascending aorta 18 months previously. In her previous operation, primary aortic repair with obliteration of the false lumen and resuspension of the aortic valve had been accomplished by means of surgical adhesive, aortic plication with felt strips, and direct closure of the aortotomy. Concomitantly, the patient had undergone bypass of the left anterior descending coronary artery with the left internal thoracic artery. She subsequently required placement of an automatic defibrillator-pacemaker and treatment for chronic congestive heart failure.

From the Cardiovascular Surgery Service of the Texas Heart Institute at St. Luke's Episcopal Hospital,[a] and the Divisions of Vascular Surgery and Endovascular Therapy[b] and Cardiothoracic Surgery,[c] Michael E. DeBakey Department of Surgery, Baylor College of Medicine, Houston, Tex.

Received for publication Sept 26, 2006; accepted for publication Oct 9, 2006.

Address for reprints: Scott A. LeMaire, One Baylor Plaza, BCM 390, Houston, TX 77030 (E-mail: slemaire@bcm.edu).

J Thorac Cardiovasc Surg 2007;133:562-3

0022-5223/$32.00

doi:10.1016/j.jtcvs.2006.10.010

The patient was referred to our center after an evaluation for chest pain revealed an expanding ascending aortic pseudoaneurysm. Because of her poor physical condition and previous sternotomy, open repair was considered to be an extremely high-risk option. Treatment with an endovascular stent-graft as a novel alternative was discussed with the patient and her family.

A retroperitoneal incision was used to access the left external iliac artery. A 7F sheath was introduced into the right brachial artery. A pigtail marker catheter was used to measure the distance between the right coronary and innominate arteries (Figure 1, *A*). A guidewire was advanced to the ascending aorta from the left external iliac artery and exchanged for an extra-stiff Lunderquist wire (Cook Medical Inc, Bloomington, Ind). A 24F guiding sheath was inserted over the stiff wire. After angiographic confirmation, a 40 × 100-mm GORE TAG thoracic endograft (W. L. Gore & Associates, Inc, Flagstaff, Ariz) was deployed through the left external iliac artery. Completion angiography confirmed total exclusion of the pseudoaneurysm, with brisk antegrade flow into the right coronary and innominate arteries (Figure 1, *B*).

The patient's initial recovery was complicated by her deconditioned state; she did not have any neurologic deficits but required extensive physical therapy because of her generalized weakness. On postoperative day 15, she had an acute brainstem stroke and died. Autopsy confirmed that the stent-graft had not migrated and that the coronary ostia and brachiocephalic arteries were patent.

Discussion

Pseudoaneurysm is an increasingly recognized complication of ascending aortic replacement; a magnetic resonance imaging study found an incidence of 13%.[5] These pseudoaneurysms have a poor prognosis because of the risks involved in complex reoperations in patients with multiple comorbidities. Endovascular approaches may provide a unique treatment opportunity for patients who have ascending aortic pseudoaneurysms but are not candidates for conventional open repair.

To be considered for treatment with an endovascular stent-graft, patients must have adequate landing zones to ensure proper